

# **Nuclear Waste Transport From California to Nevada**

**Bob Halstead**

**State of Nevada Agency for Nuclear Projects**

**Fred Dilger**

**Black Mountain Research**

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# **Nuclear Waste Transport From California to Nevada**

- **Spent Fuel Transportation Hazards**
- **National Transportation Issues**
- **Nevada Transportation Issues**
- **California Transportation Issues**

**Additional documentation available at  
[www.state.nv.us/nucwaste/trans.htm](http://www.state.nv.us/nucwaste/trans.htm)**

# Yucca Mountain Shipments

## Potential Southern California Routes



# **Yucca Mountain Shipments Potential Impact on California**

## **Over 24 Years:**

**6,867 – 48,374 trucks (13%-91%); or  
660 – 9,643 rail casks (6%-90% of total)**

## **Over 38 Years:**

**14,479 – 89,554 trucks (13%-82%); or  
1,207 – 18,046 rail casks (5%-82%)**

# Fresh Nuclear Fuel Assemblies

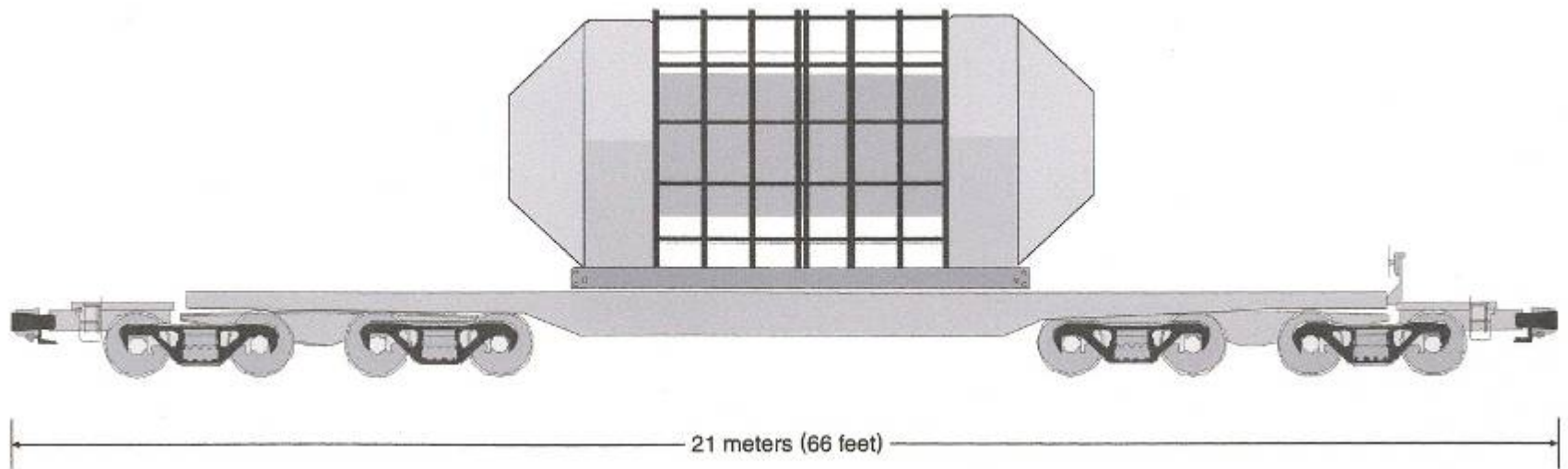
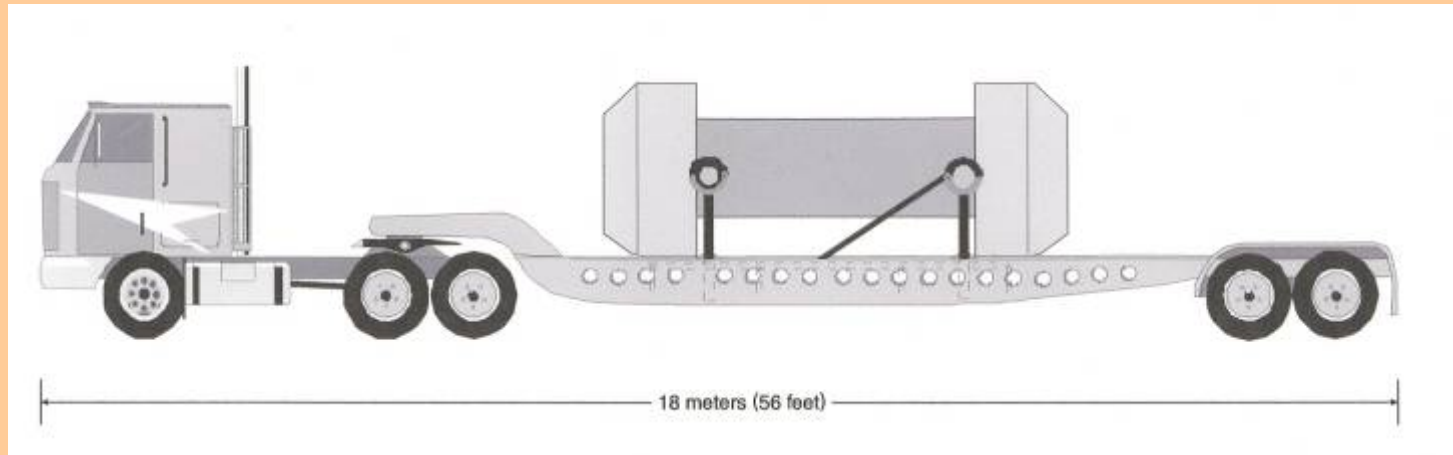


# Spent Nuclear Fuel Storage Pool



# Spent Nuclear Fuel Shipping Casks

## New, High-Capacity Designs (Artist's Conceptions)



# **Spent Nuclear Fuel Transportation Hazards**

- Direct SNF exposure deadly for 50+ years
- Each cask contains enormous amount of dangerous radioactive materials
- Routine radiation from casks hazardous to workers and to some members of public
- Cask breach in worst-case accident: 5-4,000+ latent cancer fatalities (LCFs) and \$300,000-\$10 billion+ cleanup costs
- Cask breach in successful terrorist attack: 48-1,800+ LCFs and \$10 billion+ cleanup costs
- Shipping casks not tested full-scale



# Shipping Casks Contain Large, Dangerous Payloads

- The representative truck cask (GA-4) loaded with 23-year cooled PWR SNF contains a radionuclide inventory of 355,000 curies total activity, including 136,000 curies of Cesium-137 (for 10-year cooled SNF, total inventory is 846,000 curies, including 177,000 curies of Cesium-137)
- The representative large (26 PWR) rail transport-only cask loaded with 23-year cooled PWR SNF contains a radionuclide inventory of 2,100,000 curies, including 816,000 curies of Cesium-137
- Casks loaded with HLW, DOE SNF, and Naval SNF also contain large radionuclide inventories dominated by Cesium-137 (27,000-450,000 curies)

Source: DOE FEIS, Table J-12

# NRC Regulations Establish Cask Accident Performance Standards



**30 foot drop *Onto* essentially unyielding surface**



**40 inch drop onto 6 inch steel spike**



**30-minute fire @ 1475°F**

**8-hour submersion of undamaged cask under 50 feet of water**

**Source: Sandia National Laboratories**

# **NRC Regulations Do Not Require Full-scale Cask Testing**

- NRC does not require physical testing
- 16 shipping cask designs currently certified
- No currently certified US cask has been tested full-scale to demonstrate compliance with 10CFR71(drop, puncture, fire, immersion)
- 2 truck cask designs drop-tested using half-scale models (TN-8 & GA-4)
- 3 rail cask designs drop-tested using 1/3- or 1/4-scale models (125-B, NAC-STC, TN-68)
- Scale-model impact limiter tests (9 casks)

# **Cask Vulnerability in Accidents is Unclear: Baltimore Example**

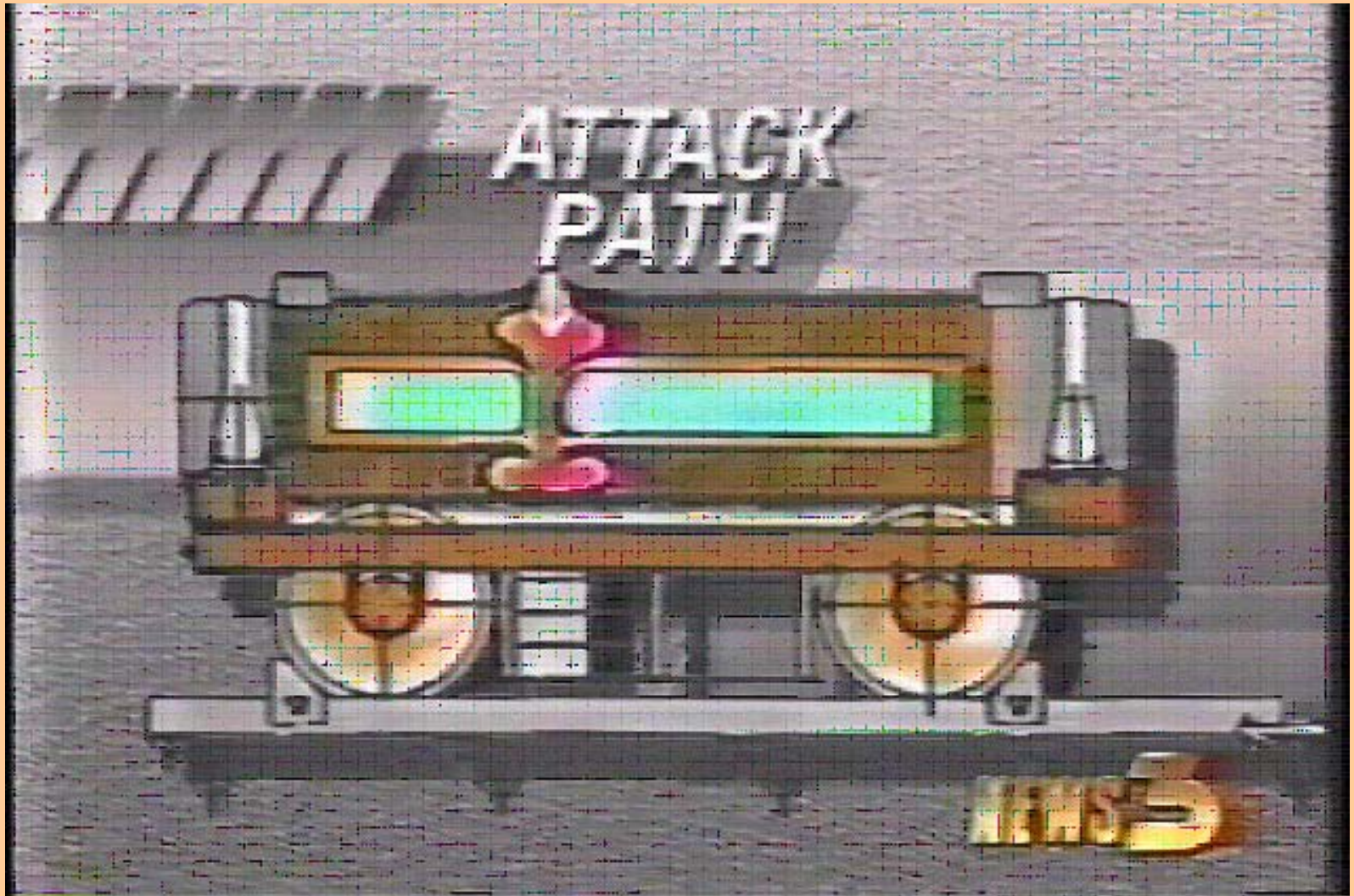
- CSX freight train derailed in Howard Street Tunnel, Baltimore, MD (2001)
- Fire fueled by tripropylene tanker and other flammable cargo
- Fire burned for 3 days, with temperatures as high as 1800°F (1000°C)
- Tunnel is located on potential shipping route from Calvert Cliffs to Yucca Mountain
- USDOT allows SNF shipment in mixed freight trains; DOE may ship in general freight service





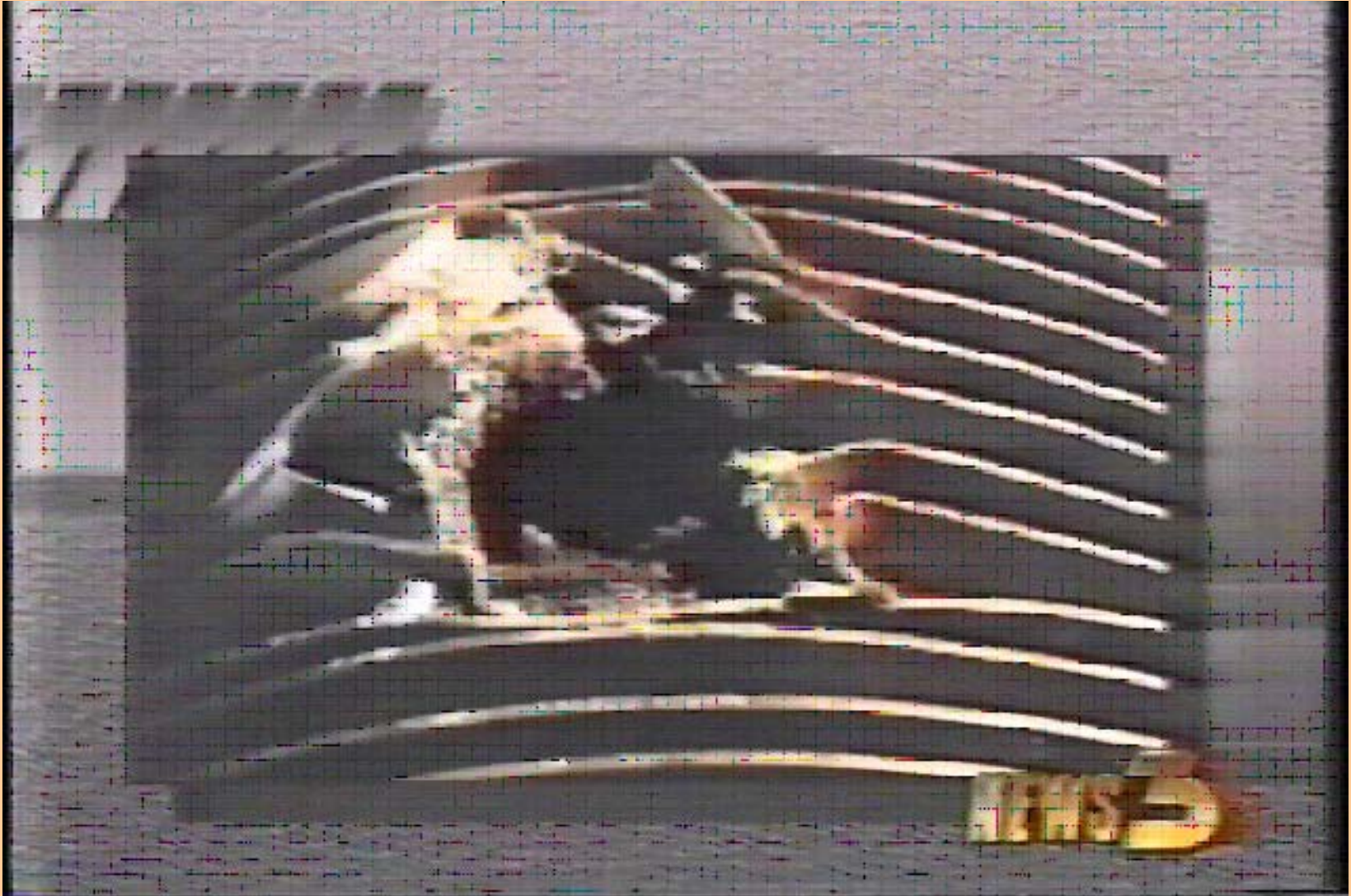


# Truck Cask Vulnerability in Attack Sandia Test, 1982



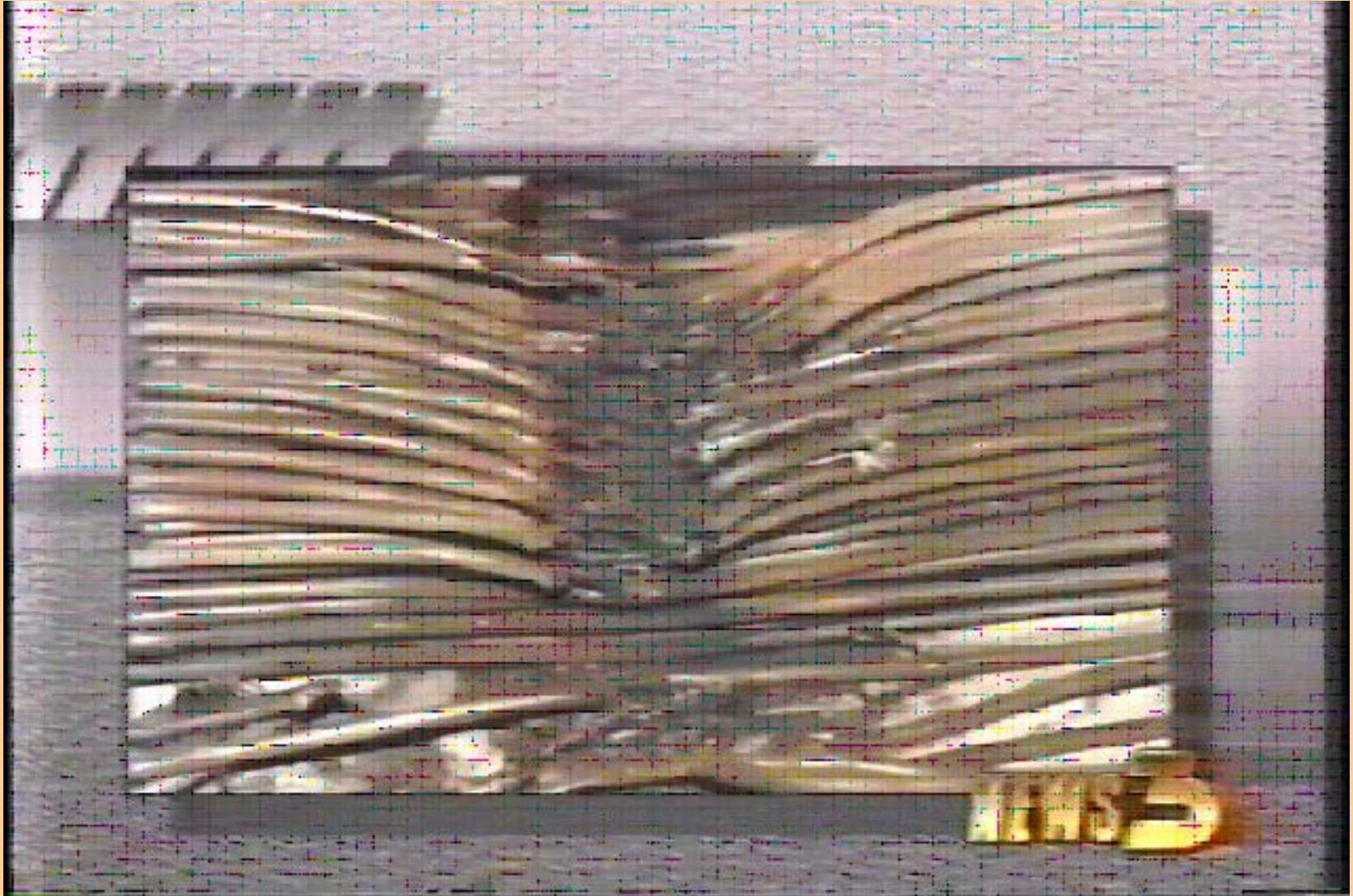


# Truck Cask Vulnerability in Attack Sandia Test, 1982





# Truck Cask Vulnerability in Attack Sandia Test, 1982



# Rail Cask Vulnerability in Attack

## IFC Test, 1998





# **Rail Cask Vulnerability in Attack IFC Test, 1998**



# **Rail Cask Vulnerability in Attack IFC Test, 1998**



# State of Nevada Transport Safety & Security Recommendations to DOE

- Oldest Fuel First
- Mostly Rail (65-75%)
- Dual-Purpose Casks
- Dedicated Trains
- Full-scale Cask Testing (Regulatory & Extra-regulatory)
- NEPA Process for Selection of Rail Spur
- WIEB “Straw Man” Routing Process
- Sec 180(c) Program Rulemaking
- State Regulatory Enhancements (Safety & Perception)
- Terrorism and Sabotage Concerns

# National Transportation Issues

- No DOE Plan for national transportation to Yucca Mountain
- DOE FEIS (2002) for Yucca Mountain evaluated mostly rail and mostly truck shipping scenarios for 24 and 38 years
- DOE ROD (2004) for Yucca Mountain selected mostly rail as preferred mode
- Feasibility of rail transportation has not been demonstrated

# **Potential Repository Shipments Over 24 Years, 2010-2033**

**Mostly Rail:** 10,725 Cask-Shipments (**about 8 rail casks and 1 truck cask per week**; additionally there would be 2,000 + barge and/or heavy haul truck shipments from 24 reactors to rail connections)

**Mostly Truck:** 53,086 Cask-Shipments (**about 6 trucks per day**, plus 300 rail casks of naval SNF shipped from Idaho in 100-300 trains)

Source: DOE-EIS-0250, Appendix J

# **Potential Repository Shipments Over 38 Years, 2010-2048**

**Mostly Rail:** 22,057 Cask-Shipments (**about 10 rail casks and 2 truck casks per week;** additionally, there would be 3,500+ barge and/or heavy haul truck shipments from 24 reactors to rail connections)

**Mostly Truck:** 108,899 Cask-Shipments (**about 8 trucks per day,** plus 355 rail casks of naval SNF and other wastes shipped from Idaho in 119-3355 trains)

Source: DOE-EIS-0250, Appendix J

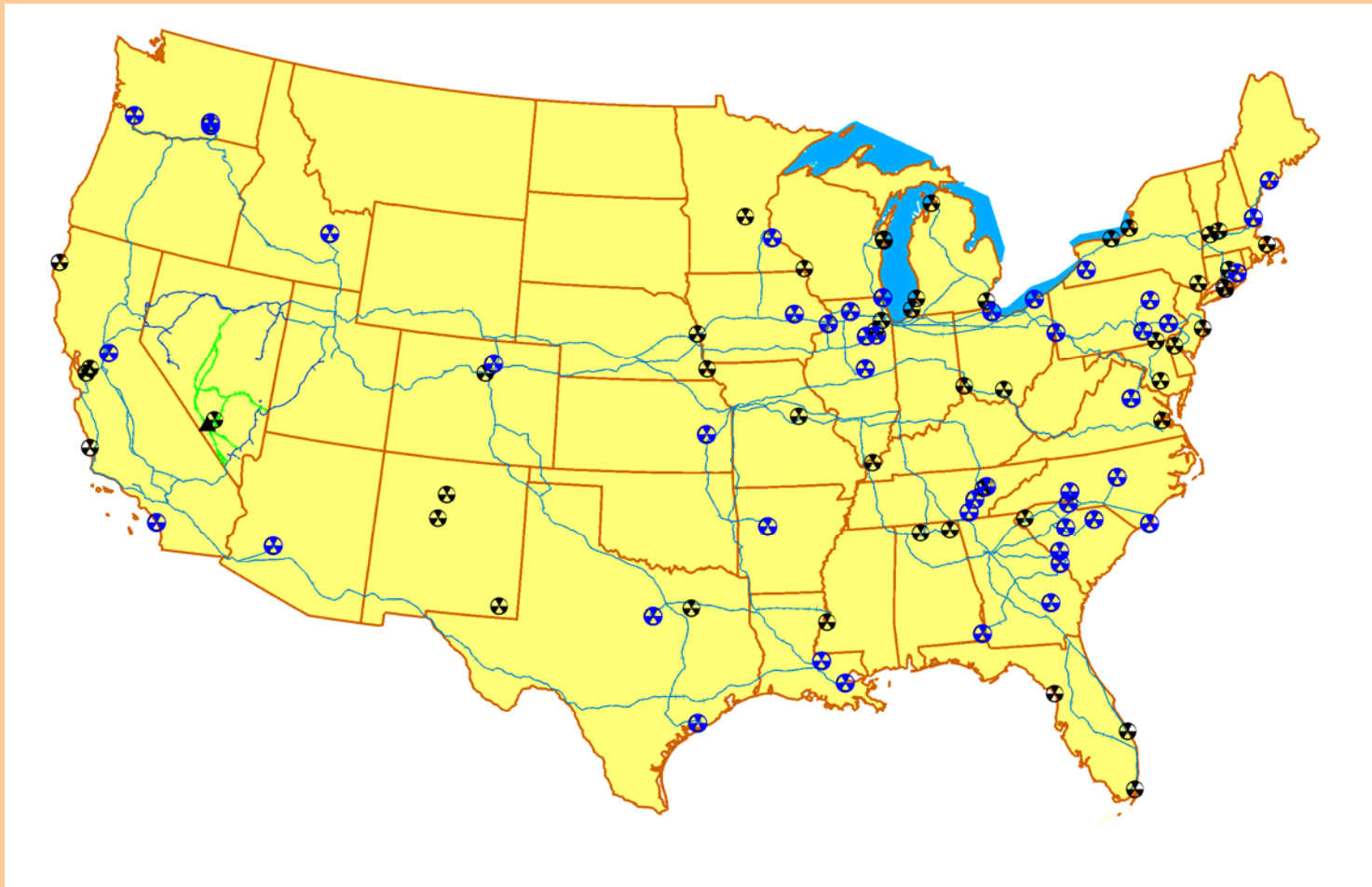


# **Yucca Mountain Shipments Compared to Past Shipments**

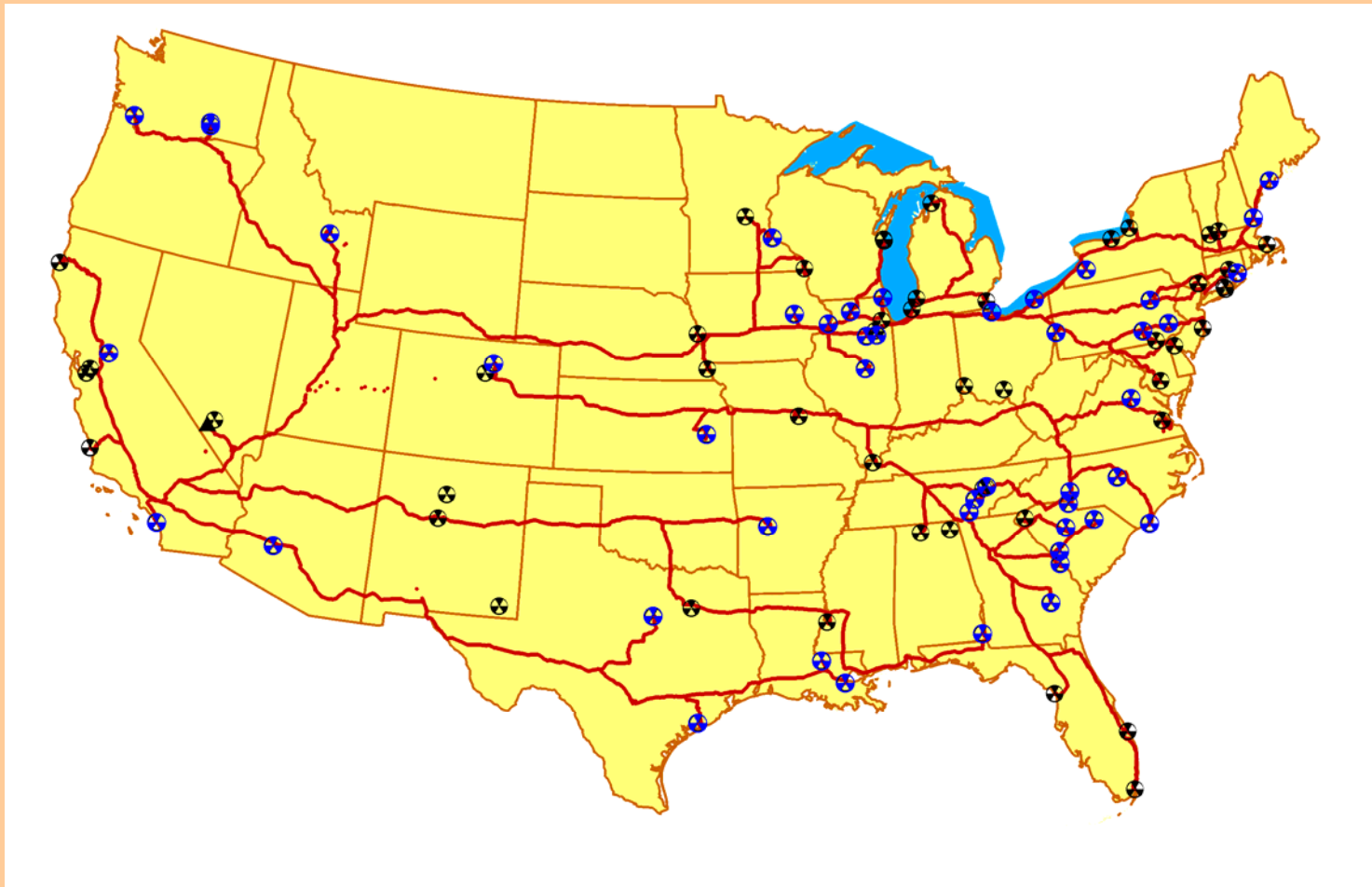
- 43 Times More SNF Shipped Per Year
- 8 to 38 Times More Casks Shipped Per Year
- 5 to 40 Times More Shipments Per Year
- 443% Increase In Average Rail Shipment Distance
- 280% Increase In Average Truck Shipment Distance
- Western Route Characteristics and Operating Conditions
- Potential Unprecedented Reliance on Heavy Haul Truck and Barge Shipments

Source: Halstead & Dilger, "How Many Did You Say? Historical and Projected Spent Nuclear Fuel Shipments in the United States, 1964-2048," Waste Management'03 Conference, February 25, 2003, Tucson, AZ

# DOE “Representative” Rail Routes to Yucca Mountain



# DOE “Representative” Truck Routes to Yucca Mountain



# **Affected Jurisdictions & Populations Along Yucca Mountain Routes**

- Truck and rail routes could traverse up to 45 states, 700 counties, and 50 Indian Reservations
- More than 120 million people live in counties traversed by truck routes
- More than 100 million people live in counties traversed by rail routes
- More than 11 million people live within one-half mile (800 meters) of a potential highway route

Source: Dilger & Halstead, Many Roads to Travel, WM'03,  
February 2003

# Nevada Rail Transportation Issues

- Currently no rail access to Yucca Mountain
- DOE FEIS (2002) evaluated 5 options
- DOE ROD (2004) selected Caliente corridor
- DOE preparing Caliente Rail DEIS (2005)
- Caliente would be longest (320 miles) new rail construction in US since 1930s (cost > \$1 billion)
- Significant environmental challenges & conflicts with ranching, mining, recreation, and Native American lands & cultural resources
- Caliente option impacts City of Las Vegas
- Heavy Haul Truck (HHT) options infeasible

# Las Vegas, Caliente Corridor, and Yucca Mountain



# Flooding & Derailment (Jan. 2005)

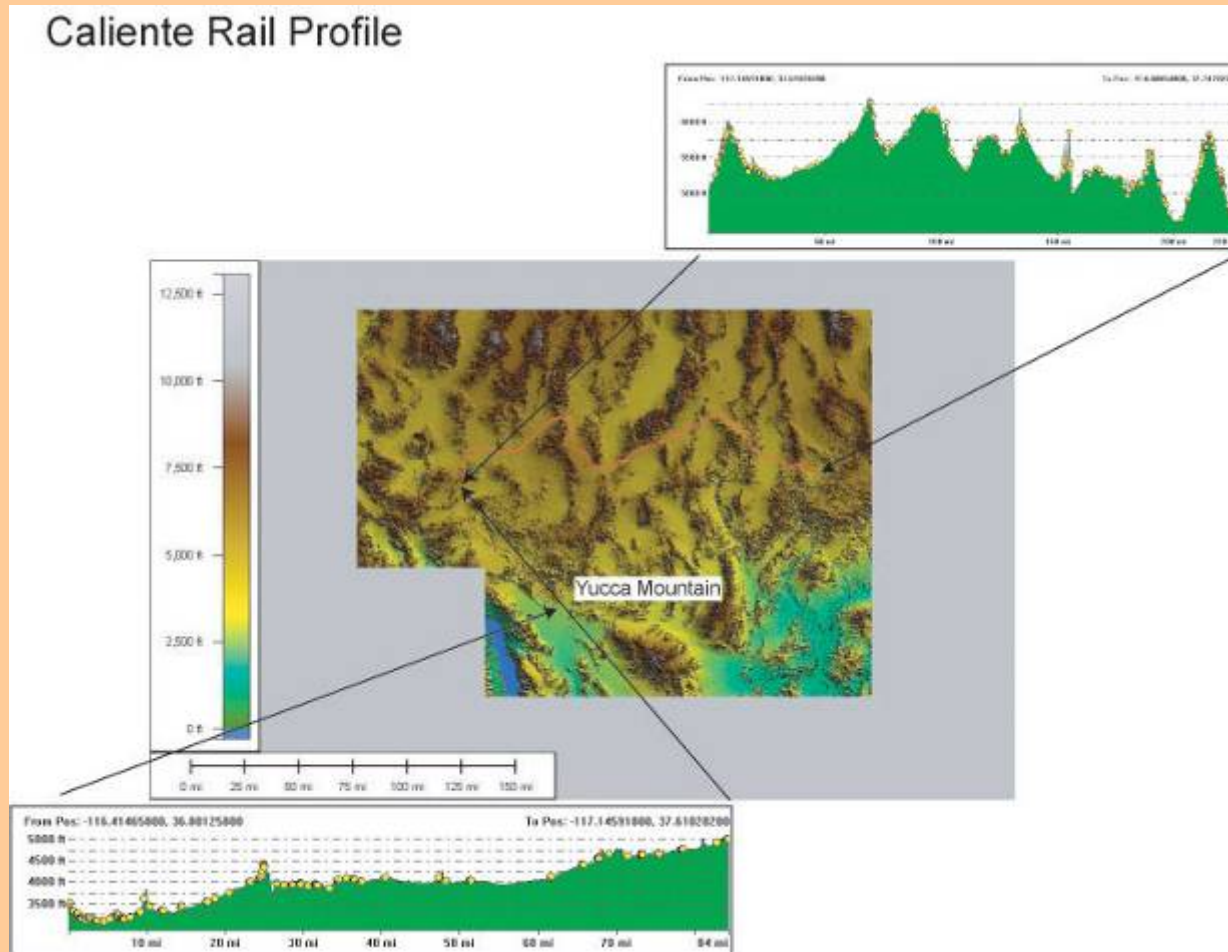
## Union Pacific RR South of Caliente





# Caliente Corridor Topography

## Severe Construction & Operation Impacts





# **Difficult Terrain Timber Mountain Pass**



# Land Use Conflict

## Heizer Land Sculpture “City”





# **Difficult Terrain**

## **Joe Fallini, Reveille Valley**



# Land Use Conflict

## Historical Family Ranch Operations





# **Land Use Conflict**

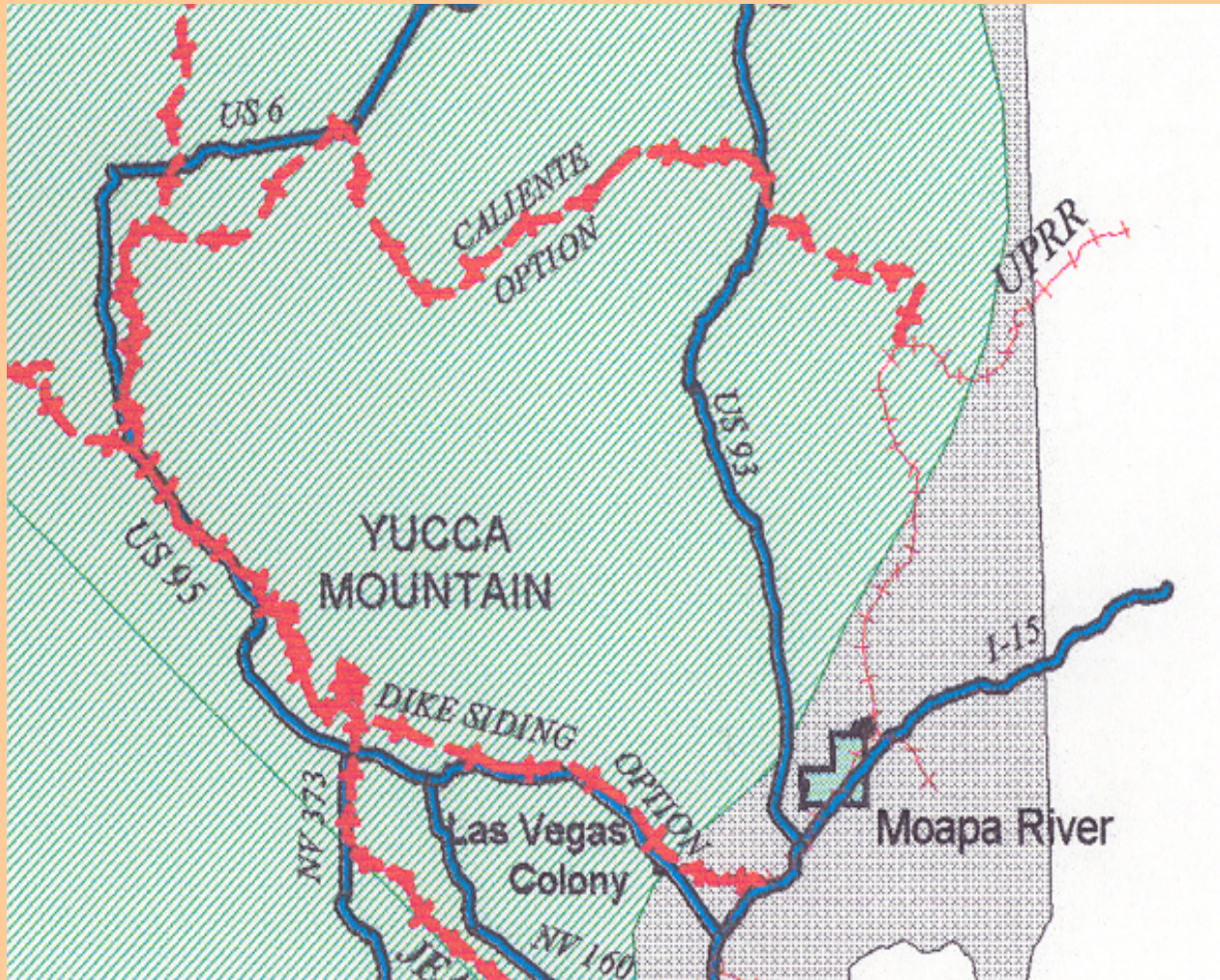
## **Goldfield Mining District**





# Western Shoshone Land Claims

(Treaty of Ruby Valley)



# Military Aircraft Over-flights



# Endangered Species



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# Potential Impacts on Las Vegas

Up to 89% of rail shipments through Las Vegas



# Potential Impacts on Las Vegas

More than 80,000 people within one-half mile



# Rail Access Summary

- Direct rail access to national rail network is highly desirable for repository site
- Yucca Mountain site lacks rail access
- DOE has not demonstrated feasibility of any of the 5 rail access options identified in the FEIS
- Alternative to rail spur, HHT delivery from intermodal transfer station, probably not feasible
- Rail shipments through downtown Las Vegas will be a major issue in any future DOE transportation planning activities

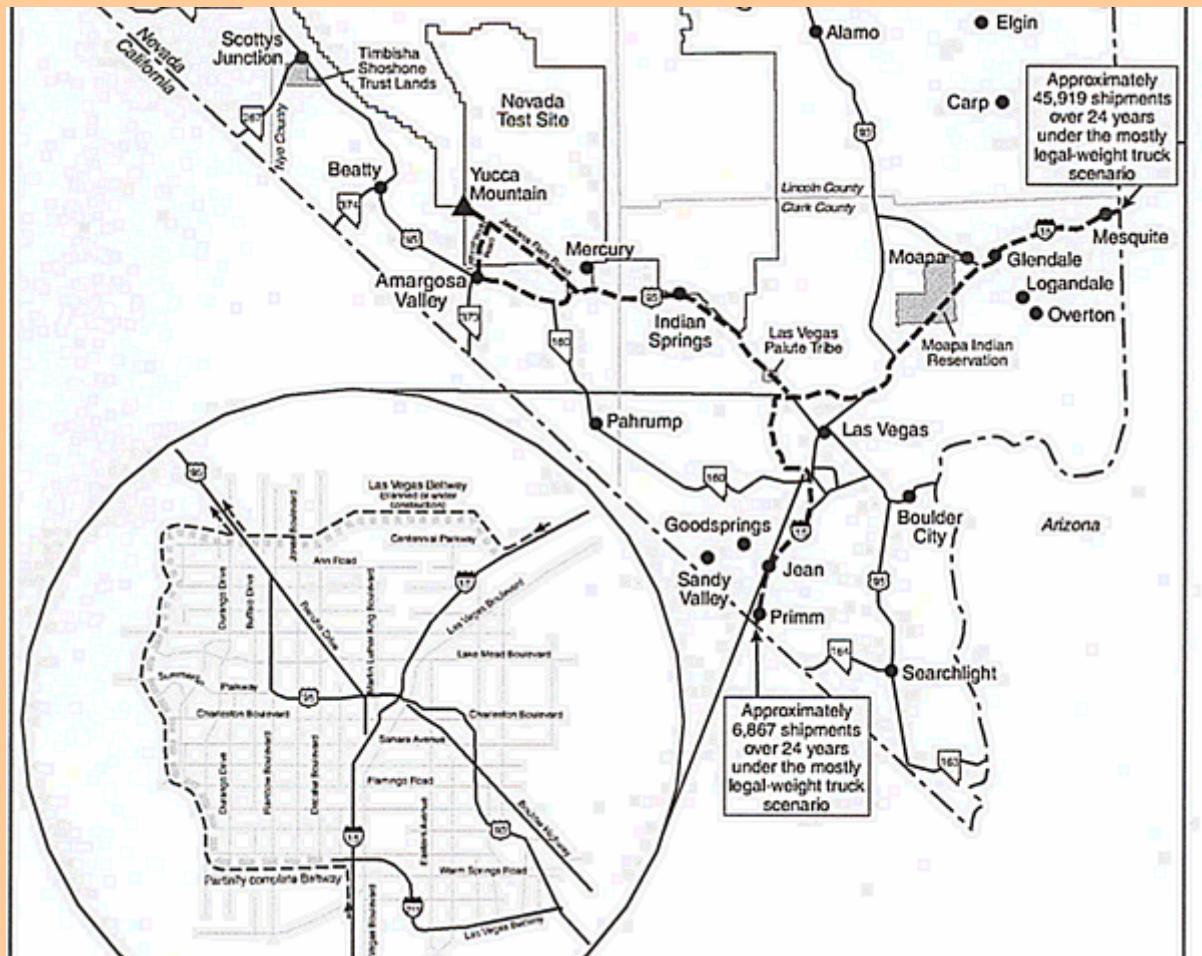


# **State of Nevada Lawsuit Challenging DOE Rail Decisions**

- Complaint Filed 9-8-04 in US Court of Appeals for the District of Columbia Circuit; Brief Filed 3-24-05
- Challenges DOE improper assumption of lead agency status for preparation of rail corridor EIS
- Challenges DOE failure to prepare Supplemental EIS on LWT/rail intermodal transportation
- Challenges DOE failure to identify and study preferred rail corridor in Yucca Mountain Final EIS
- Requests that the Court set aside DOE's lead agency status, DOE's selection of a composite transportation mode, and DOE's selection of the Caliente corridor

# DOE Proposed Truck Routes From UT/AZ & CA

## I-15, I-215, US 95 Through Las Vegas



# Potential Alternative Truck Route From UT

## **NDOT B Route: US93A, US6, US95**





NDOT B ROUTE

# **I-80/US93A: West Wendover**



NDOT B ROUTE

# **US6: Murry Summit**

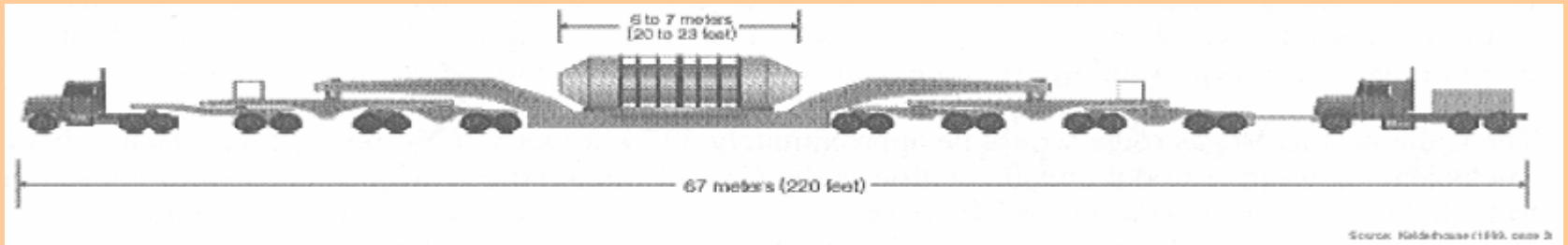


NDOT B ROUTE

# US95: Goldfield



# Possible Heavy Haul Truck Rig for Yucca Mountain Shipments





POSSIBLE LWT/HHT ROUTE

# US93: Caliente



POSSIBLE LWT/HHT ROUTE

# **US93: 9-Mile Ascent to Summit**





POSSIBLE LWT/HHT ROUTE

# **SR375: Hancock Summit**

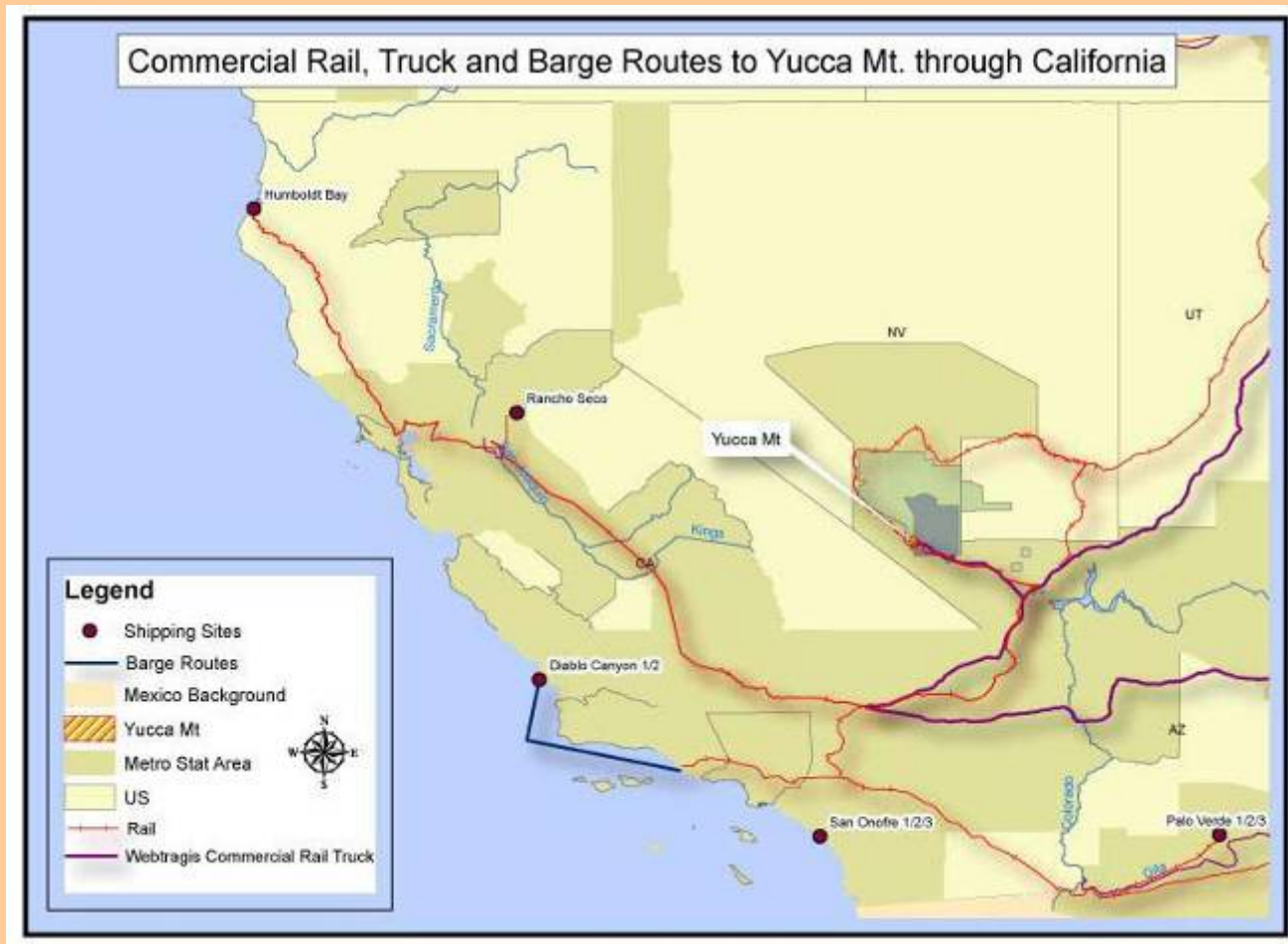


# POSSIBLE LWT/HHT ROUTE

## SR375: Rachel



# CA Routes For Mostly Rail Shipments to Yucca Mountain





# CA Cities Affected by Mostly Rail Shipments to Yucca Mountain



# CA Routes For Mostly Truck Shipments to Yucca Mountain



# Shipments to Yucca Mountain





# **Population Within ½ Mile of CA Routes to Yucca Mountain**

<b>Shipment Mode</b>	<b>Population (2000) Within ½ Mile of CA Routes</b>
<b>Mostly Truck</b>	<b>612,875</b>
<b>Mostly Rail</b>	<b>2,007,326</b>

# **Base Case California Rail Shipments to Yucca Mountain**

	<b>24 Years (Casks)</b>	<b>38 Years (Casks)</b>
<b>Diablo Canyon</b>	<b>121</b>	<b>308</b>
<b>Humboldt Bay</b>	<b>6</b>	<b>6</b>
<b>Rancho Seco</b>	<b>21</b>	<b>21</b>
<b>San Onofre</b>	<b>138</b>	<b>277</b>
	<b>286</b>	<b>612</b>

# Base Case California Truck Shipments to Yucca Mountain

	24 Years (Casks)	38 Years (Casks)
Diablo Canyon	729	2,101
Humboldt Bay	44	44
Rancho Seco	124	124
San Onofre	853	1,698
	1,750	3,967

# **Base Case Total Shipments to Yucca Mountain through California**

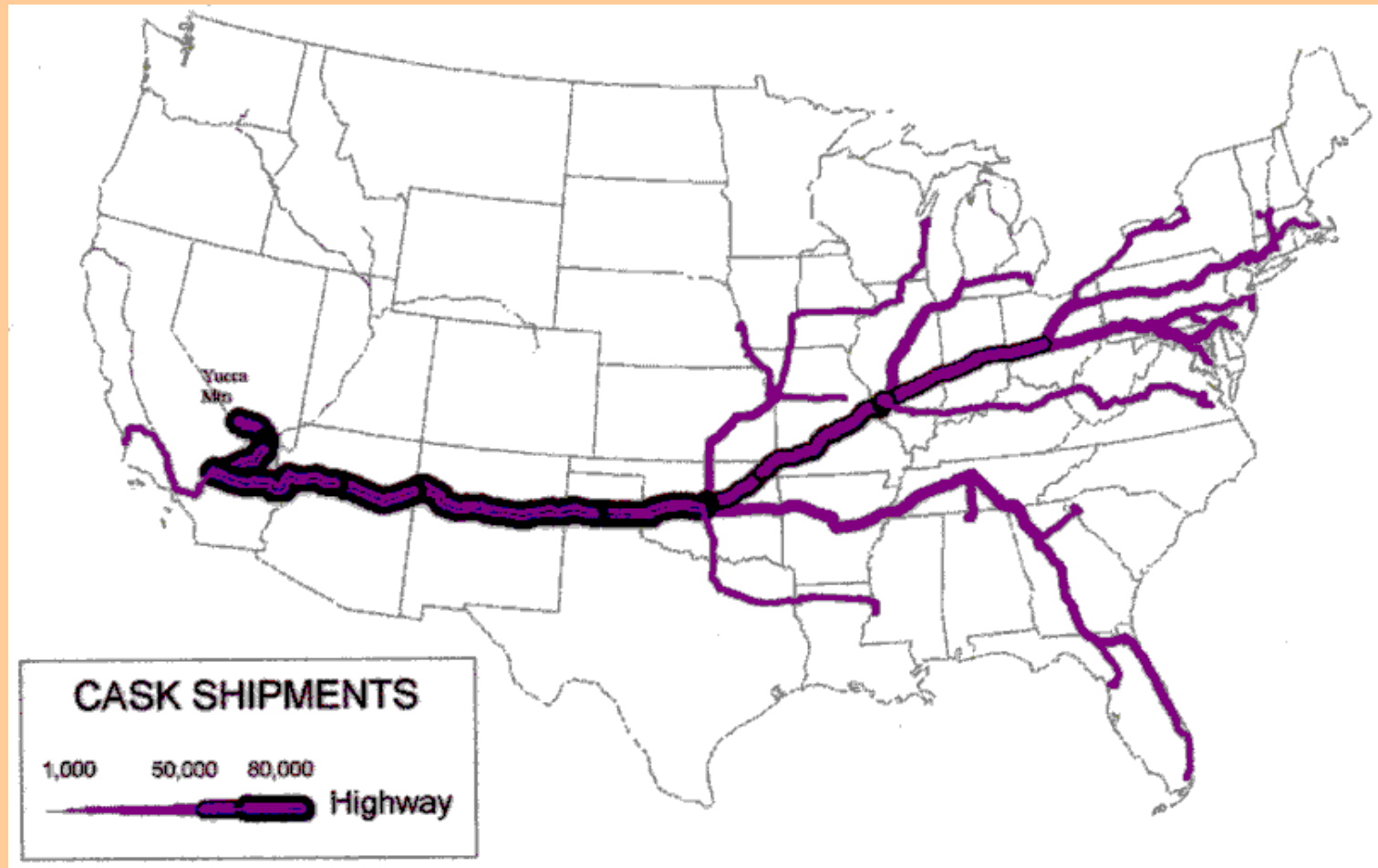
	<b>24 Years (Casks)</b>	<b>38 Years (Casks)</b>
<b>Mostly Truck Scenario</b>	<b>6,867 (13%)</b>	<b>14,479 (13%)</b>
<b>Mostly Rail Scenario</b>	<b>660 (6%)</b>	<b>1,207 (5%)</b>



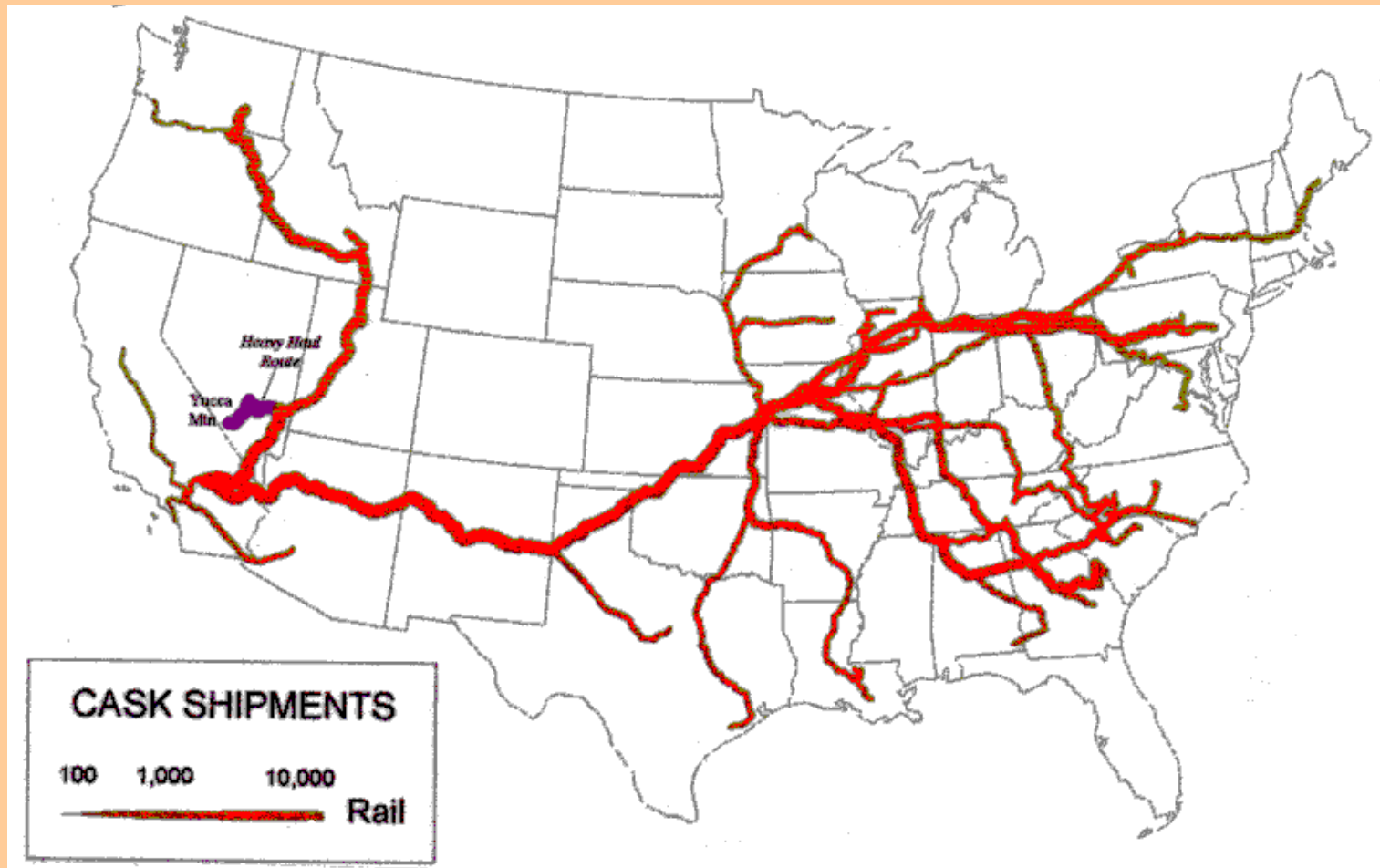
# **Maximum Total Shipments to Yucca Mountain through California**

	<b>24 Years</b>	<b>38 Years</b>
<b>Mostly Truck Scenario</b>	<b>48,374 (91%)</b>	<b>89,554 (82%)</b>
<b>Mostly Rail Scenario</b>	<b>9,643 (90%)</b>	<b>18,046 (82%)</b>

# Maximum Truck Shipments Through CA (Southern Consolidated Routing)



# Maximum Rail Shipments Through CA (Southern Consolidated Routing)



# Rail Route Choice in Chicago Will Determine Impacts in California



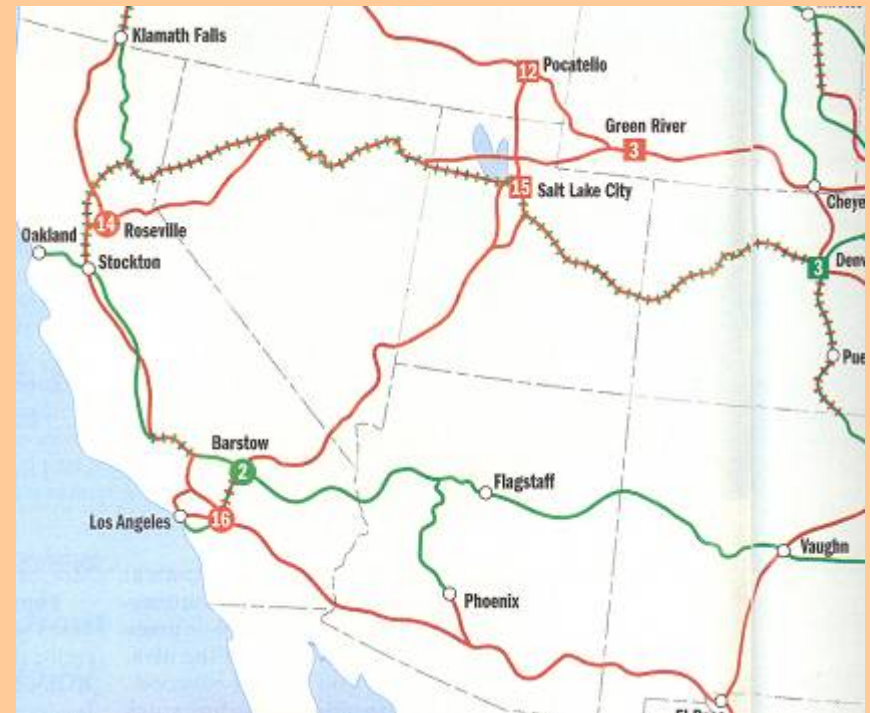


# Rail Route Choice in Chicago Will Determine Impacts in California

UP Proviso Yard, Sears Tower



# Rail Route Choice in Nebraska Will Determine Impacts in California





# Most Likely Scenario if Shipments Started Now: Trucks Through CA



# Questions?

